

NONRESIDENTIAL ACM MANUAL APPENDIX ND

Appendix ND - Compliance Procedures for Relocatable Public School Buildings

ND.1 Purpose and Scope

This document describes the compliance procedures that shall be followed when the whole building performance approach is used for relocatable public school buildings. Relocatable public school buildings are constructed (manufactured) at a central location and could be shipped and installed in any California climate zone. Furthermore, once they arrive at the school site, they could be positioned so that the windows face in any direction. The portable nature of relocatable classrooms requires that a special procedure be followed for showing compliance when the whole building performance method is used. Compliance documentation for relocatable public school buildings will be reviewed by the Division of the State Architect.

ND.2 The Plan Check Process

The Division of the State Architect (DSA) is the building department for relocatable public school buildings. Since relocatables are manufactured in batches, like cars or other manufactured products, the plan check and approval process occurs in two phases. The first phase is when the relocatable manufacturer completes design of a model or modifies a model. At this point, complete plans and specifications are submitted to the DSA; DSA reviews the plans for compliance with the energy standards and other California Building Code (CBC) requirements; and a "pre-check" (PC) design approval is granted. Once the PC design is approved, a school district or the manufacturer may file an "over-the-counter" application with DSA to construct one or more relocatables. The over-the-counter application is intended to be reviewed quickly, since the PC design has already been pre-checked. The over-the-counter application is the building permit application for construction and installation of a relocatable at a specific site, and includes the approved PC design drawings as well as site development plans for the proposed site where the relocatable will be installed. An over-the-counter application also is required for the construction of a stockpile of one or more relocatables based on the approved PC design drawings. Stockpiled relocatables are stored typically at the manufacturer's yard until the actual school site is determined where the relocatable will be installed. Another over-the-counter application is required to install a previously stockpiled relocatable at which time site development plans for the proposed site are checked.

The effective date for all buildings subject to the energy standards is the date of permit application. If a building permit application is submitted on or after the effective date, then the new energy standards apply. For relocatable classrooms, the date of the permit application is the date of the over-the-counter application, not the date of the application for PC design approval. The PC design is only valid until the code changes.

ND.3 The Compliance Process

Like other nonresidential buildings, the standard design for relocatable public school buildings is defined by the prescriptive requirements. In the case of relocatables, there are two choices of prescriptive criteria:

- Table 143-C in the Standards may be used for relocatable school buildings that can be installed in any climate zone in the state. In this case, the compliance is demonstrated in climates 14, 15, and 16 and this is accepted as evidence that the classroom will comply in all climate zones. These relocatables will have a permanent label that allows it to be used anywhere in the state.
- Table 143-A in the Standards may be used for relocatable school buildings that are to be installed in only specific climate zones. In this case, compliance is demonstrated in each climate zone for which the

relocatable has been designed to comply. These relocatables will have a permanent label that identifies in which climate zones it may be installed. It is not lawful to install the relocatable in other climate zones.

The building envelope of the standard design has the same geometry as the proposed design, including window area and position of windows on the exterior walls, and meets the prescriptive requirements specified in §143. Lighting power for the standard design meets the prescriptive requirements specified in §146. The HVAC system for the standard design meets the prescriptive requirements specified in §144. The system typically installed in relocatables is a single-zone packaged heat pump or furnace. Most relocatable school buildings do not have water heating systems, so this component is neutral in the analysis. Other modeling assumptions such as equipment loads, are the same for both the proposed design and the standard design and are specified in the Nonresidential ACM Manual.

Manufacturers shall certify compliance with the standards and all compliance documentation shall be provided. If the manufacturer chooses to comply using Table 143-A for compliance in only specific climate zones, then the manufacturers shall indicate the climate zones for which the classroom will be allowed to be located.

Since relocatable public school buildings could be positioned in any orientation, it is necessary to perform compliance calculations for multiple orientations. Each model with the same proposed design energy features shall be rotated through 12 different orientations either in climate zones 14, 15 and 16 for relocatables showing statewide compliance or in the specific climate zones that the manufacturer proposes for the relocatable to be allowed to be installed, i.e., the building with the same proposed design energy features is rotated in 30 degree increments and shall comply in each case. Approved compliance programs shall automate the rotation of the building and reporting of the compliance results to insure it is done correctly and uniformly and to avoid unnecessary documentation.

ND.4 Documentation

The program shall present the results of the compliance calculations in a format similar to Table ND-1. For each of the cases (12 orientations times number of climates), the Time Dependent Valuation (TDV) energy for the *Standard Design* and the *Proposed Design* are shown (the energy features of the *Proposed Design* shall be the same for all orientations). The final column shows the compliance margin, which is the difference between the TDV energy for the *Proposed Design* and the *Standard Design*. Approved compliance programs shall scan the data presented in the Table ND-1 format and prominently highlight the case that has the smallest compliance margin. Complete compliance documentation shall be submitted for the building and energy features that achieve compliance in all of the climate zones and orientations as represented by the case with the smallest margin. DSA may require that compliance documentation for other cases also be submitted; showing that the *Proposed Design* building and energy features are identical to the case submitted, in each orientation and climate zone. Table ND-1 shows rows for climate zones 14, 15, and 16, which are the ones used when the criteria of Table 143-C is used to show compliance throughout the state. If the criteria of Table 143-A is used, then rows shall be added to the table for each climate zone for which the manufacturer wants the relocatable to be allowed to be installed.

Table ND-1 – Summary of Compliance Calculations Needed for Relocatable Classrooms

Climate Zone	Azimuth	TDV Energy		
		Proposed Design	Standard Design	Compliance Margin
14	0			
	30			
	60			
	90			
	120			
	150			
	180			
	210			
	240			
	270			
	300			
	330			
15	0			
	30			
	60			
	90			
	120			
	150			
	180			
	210			
	240			
	270			
	300			
	330			
16	0			
	30			
	60			
	90			
	120			
	150			
	180			
	210			
	240			
	270			
	300			
	330			

ND.5 Optional Features

Relocatable classrooms may come with a variety of optional features, like cars. A school district can buy the “basic model” or it can pay for options. Many of the optional features do not affect energy efficiency and are not significant from the perspective of energy code compliance. Examples include floor finishes (various grades of carpet or tiles), casework, and ceiling and wall finishes. Other optional features do affect energy performance such as window construction, insulation, lighting systems, lighting controls, HVAC ductwork, HVAC equipment, and HVAC controls.

When a manufacturer offers a relocatable classroom model with a variety of options, it is necessary to identify those options that affect energy performance and to show that the model complies with any combination of the optional features. Most of the time, optional energy features are upgrades that clearly improve performance. If the basic model complies with the Standards, then adding any or all of the optional features would improve performance. The following are examples of optional features that are clear upgrades in terms of energy performance:

- HVAC equipment that has both a higher SEER and higher EER than the equipment in the basic model.
- Lighting systems that result in less power than the basic model.
- Lighting controls, such as occupancy sensors, that are recognized by the standards and for which power adjustment factors in Table 146-A are published in Section 146 of the Standards.
- Windows that have both a lower SHGC and lower U-factor (limited to relocatables that do not take credit for daylighting).
- Wall, roof or floor construction options that result in a lower U-factor than the basic model.

For energy code compliance purposes, it is necessary to show that every variation of the relocatable classroom that is offered to customers will comply with the Standards. There are two approaches for achieving this, as defined below:

1) Basic Model Plus Energy Upgrades Approach The simplest approach is to show that the basic model complies with the Standards and that all of the options that are offered to customers are clear energy upgrades that would only improve performance. As long as each and every measure in the basic model is met or exceeded by the energy upgrades, the relocatable classroom will comply with the standards.

While clear upgrades are obvious in most cases, the following are some examples of options that are not energy upgrades, for which additional analysis would be needed to show compliance that every combination of options comply.

- HVAC equipment that has a higher SEER, but a lower EER.
- Windows that lower SHGC but increase U-factor, or vice versa.
- Insulation options that reduce the U-factor for say walls, but increase it for the roof.
- Any other combination of measures that results in the performance of anyone measure being reduced in comparison to a complying basic model.

2) Modeling of Every Combination Approach. A more complex whole building performance approach is required when a model is available with options which in combination may or may not comply. In this case every combination of options shall be modeled, and the specific combinations that comply shall be determined and only those combinations shall be allowed. This approach, while possible, requires considerably more effort on the part of the relocatable manufacturer and its energy consultant. It also places a greater burden on DSA when they issue the over-the-counter building permit for the PC design that only allows specific combinations of energy options.. DSA would have to examine the specific optional features that are proposed with the over-the-counter application and make sure that the proposed combination of measures achieves compliance.

The manufacturer or its energy consultant would need to prepare a table or chart that shows all of the acceptable combinations that achieve compliance. This chart could be quite complex, depending on the number of optional features that are offered.

Table ND-2 is intended to illustrate the complexity that could be involved in modeling of every combination of energy features. It shows a list of typical optional features that would affect energy performance. In this example, there are two possible for each of the eight options, e.g the feature is either there or not (in an actual case there could be a different number of options and a different number of states for any option). In the example any one of the features could be combined with any of the others. The number of possible combinations in this example is two (the number of states) to the eighth power (the number of measures that

have two states). The number of possible options is then 2^8 or 256. This is the number of combinations that would need to be modeled in order to determine which combinations of optional features achieves compliance.

Table ND-2 – Examples of Optional Features for Relocatable Classrooms

Options Offered	States
1 Efficient lighting option	Yes/No
2 High efficiency heat pump	Yes/No
3 Improved wall insulation	Yes/No
4 Improved roof insulation	Yes/No
5 Occupancy sensor for lighting	Yes/No
6 Low -e windows	Yes/No
7 Skylights	Yes/No
8 Daylighting Controls	Yes/No